ARCHITECTURE OF INTEGRATED INFORMATION SYSTEM FOR ANALYSIS OF POTENTIAL OF RENEWABLE ENERGY SOURCES

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Some characteristics and features of architecture of integrated information system for analysis of potential of renewable energy sources are considered, that is opened for enhancement and realization of appropriate functionality, in particular development of special algorithms and program modules of interaction with database and graphical user interface within it.

Keywords: architecture, integrated information system, analysis of potential, renewable energy sources.

In the Republic of Belarus the efficient use of renewable (alternative or non-conventional) energy sources is largely dependent on the correct assessment of the resource potential of the region, the availability of appropriate technology and equipment, the required infrastructure and the regulatory framework.

For the design and development of Web-based integrated information system for analysis of potential of renewable energy sources that is creating in the Belarusian National Technical University, as well as any other structurally and functionally complex software for working with cartographic information, corresponding technologies were chosen in such a way as to minimize the time spent on development, to make the software product maintenance more simple, and also to provide high productivity of the application.

In particular, the selected technologies should solve the following tasks and problems:

- work with dynamically changing content of client Web-pages without its' reloading;
- implementation of the software user interface on the side of the Web-server;
- creation of a level of access to information stored in the database for use in the software user interface and others.

The architecture of the module for working with cartographic information includes:

- client part containing a graphical user interface and a level for working with the server API;
- server part containing the levels of interaction with the database and the views and relationships between the levels of the application.

Developed modules for working with cartographic information are modules for a Web-application developed in accordance with the technology of Microsoft ASP.NET MVC. The developed system uses Microsoft .NET technology on the server side and AJAX technology for background communication between the client and the server.

When developing in a Microsoft Visual Studio environment, the application was divided into 2 projects for software implementation:

- level of access to the database;
- graphical user interface.

Such a partition simplifies development and also reduces the time required to replace a data source.

The architecture of the integrated information system includes the following components:

- the object model of the database – is a set of classes corresponding to the database tables. Stored procedures are represented by functions;
- repositories – isolate heterogeneous data from each other and include mechanisms for managing this data. For example, the repository of wind generators includes functions for selection, editing, deleting and assortment of appropriate equipment for objects, as well as calculating of the energy efficiency of the equipment;
- Web API-controllers – return and receive data in a "raw" form (JSON is used). The client application processes and displays the data (JavaScript is used). The controllers of the specified type are used, because the cartographic interface requires operation without reloading the Web-page;
- MVC-controllers – form finished Web-pages and return them to the user.

Thus, a selection of modern technologies and tools for the optimal technical implementation of integrated information system for analysis of potential of renewable energy sources was made. Also, the architecture of this

system is developed, which is open for the expansion and realization of the corresponding functionality, in particular, the development of appropriate algorithms and software modules for interaction with the database and graphical user interface within the system.

CALCULATED STUDY OF DROPLET ENTRAINMENT PROCESSES OF BORIC ACID

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The processes of droplet entrainment of soluble substances with steam during the operation of nuclear power plants have a significant impact on the ecological situation. This effect can be expressed in increasing the humidity of the ambient air by using evaporative cooling towers or influencing the possibility of cooling the core of the reactor in the event of an accident. To study these processes in the IPPE, the calculated simulation of the droplet entrainment of boric acid was carried out, the results of which are presented in this paper.

Keywords: boric acid, droplet entrainment, reactor, accident, environment

Ensuring the safety of modern NPP projects in order to prevent accidents that can have a negative ecological impact on the environment is one of the most urgent tasks facing modern nuclear energy. Within the framework of the WWER-TOI project, special attention is paid to ensuring reactor safety in case of beyond-design accidents with a break in the main circulation circuit and loss of all AC sources within 72 hours. This task is solved by the functioning of passive safety systems that provide cooling of the core due to the consecutive supply of a solution of boric acid in the reactor with a concentration of 16 g / kg from the system of hydraulic tanks. As is known, the reactor core is at this time in a boiling state, correspondingly, taking into account the low acid concentration in the vapor phase, it is possible to increase the amount of boric acid in the core coolant and to achieve the conditions for its crystallization on the outer surface of the fuel rods, which may lead to a deterioration of the heat sink. The limiting concentration of a solution of boric acid, corresponding to the onset of crystallization, depends on the temperature.

To estimate the possibility of this process in the core of WWER, a calculation was made of the accumulation of boric acid in the reactor in the emergency mode. When carrying out the calculation, the following conservative assumptions were made: boric acid is considered as the only form of boron accumulation, boron drift of boric acid is absent. The results of the calculation analysis show that in the event of an accident, a sufficiently intensive accumulation of boric acid in the core of the reactor takes place. The maximum concentration of boric acid by the end of 72 hours significantly exceeds the limiting concentration [1], and, accordingly, can lead to its crystallization on the fuel element surface. The process of crystallization of boric acid in the core can be slowed down or even completely eliminated due to the removal of a part of boric acid with the vapor leaving the core. Therefore, in the future, in order to reduce the conservativeness of calculations, experimental studies of the processes of droplet entrainment processes of boric entrainment are necessary.

The results obtained will help to justify the safety of new NPP projects and ensure reliable operation of passive safety systems to guarantee that the accident does not transform to a serious stage, with the possible release of radioactive fission products into the environment and causing great environmental damage.

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